WHAT IS CLAIMED IS:

Claim 1: A method of making a tubular ceramic/metal composite comprising

associating a polymeric ceramic precursor having a thermal expansion lower than said metallic element with at least one tubular metallic element to form a preceramic composite, and

subjecting said composite to pyrolysis by high frequency microwave radiation, until the polymeric ceramic precursor is converted into a ceramic having said at least one tubular metallic element integrally formed as part of said composite.

Claim 2: The method of claim 1 wherein the microwave radiation is in the form of a beam.

Claim 3: The method of claim 2 wherein the preceramic ceramic precursor is a fiber-reinforced fluid placed in a microwave-permeable mold loaded with a susceptor.

Claim 4: The method of claim 3 wherein the microwave radiation is at least about 20 GHz or greater.

Claim 5: The method of claim 1 wherein the metallic element is grounded prior to exposure to high frequency microwave radiation.

Claim 6: The method of claim 1 wherein the susceptor is a continuous SiC fiber, chopped SiC fiber, milled SiC fiber, SiC whisker, SiC particulate, SiC flake, continuous carbon or graphite fiber, chopped carbon or graphite fiber, milled carbon or graphite fiber, carbon or graphite whisker, carbon or graphite

particulate, carbon or graphite flake, or other forms of SiC, carbon, and graphite found to be effective susceptors.

Claim 7: The method of claim 6 wherein the susceptor is a SiC.

Claim 8: The method of claim 1 wherein the metallic element is made of any metal and/or metal alloy that can conduct electricity in a metallic fashion.

Claim 9: A method of making a tubular ceramic/metal composite comprising placing a fiber-reinforced fluid polymeric ceramic precursor having a lower thermal expansion than that of the metal element and loaded with a susceptor in a mold,

associating therewith at least one tubular metallic element made of any metal and/or metal alloy that can conduct electricity in a metallic fashion to form a preceramic composite, and

subjecting said composite to pyrolysis by microwave radiation of at least about 20 GHz or greater for a time sufficient to convert said polymeric ceramic precursor to a ceramic having said at least one tubular metallic element integrally formed as part of said ceramic composite.

Claim 10: The method of claim 9 wherein the microwave radiation is in the form of a movable beam.

Claim 11: The method of claim 10 wherein said susceptor is a continuous SiC fiber, chopped SiC fiber, milled SiC fiber, SiC whisker, SiC particulate, SiC flake, continuous carbon or graphite fiber, chopped carbon or graphite fiber, milled carbon or graphite fiber, carbon or graphite whisker, carbon or graphite particulate, carbon or graphite flake, or other forms of SiC, carbon, and graphite found to be effective susceptors.

Claim 12: The method of claim 11 wherein the susceptor is a SiC.

Claim 13: The method of claim 9 wherein the ceramic is densified by adding additional polymeric ceramic polymer thereto and

again pyrolyzing the composite by said energy.

Claim 14: A method of making a tubular ceramic/metal composite comprising

forming a fiber reinforcement infiltrated with a polymeric ceramic precursor having a lower thermal expansion than that of the metal element, associating at least one tubular metallic element therewith to form a preceramic composite,

and

subjecting said composite to pyrolysis by high frequency microwave radiation, until the polymeric ceramic precursor in said composite is converted into a ceramic having said at least one tubular metallic element integrally formed therewith.

Claim 15: The method of claim 14 wherein the microwave radiation is in the form of a beam.

Claim 16: The method of claim 15 wherein the microwave radiation is at least about 20 GHz or greater.

Claim 17: The method of claim 15 wherein the metallic element is made of any metal and/or metal alloy that can conduct electricity in a metallic fashion.

Claim 18: The method of claim 14 wherein said ceramic/metal composite coated with at least one additional polymeric preceramic precursor and then pyrolysis thereof by said high frequency microwave radiation.

Claim 19: A tubular ceramic/metal composite comprising a ceramic outer layer and at least one tubular metallic element inner layer wherein

said at least one tubular metallic element is first associated with a fiber reinforcement infiltrated with a polymeric ceramic precursor having a thermal expansion lower than that of said metallic element to form a composite and

said composite then subjected to a beam of high frequency microwave radiation to pyrolyze said polymeric ceramic precursor to a ceramic.

Claim 20: A fiber reinforced tubular ceramic/metal composite having integrally formed therewith at least one metallic element wherein

said at least one tubular metallic element is first associated with a fiber reinforcement infiltrated with a polymeric ceramic precursor having a thermal expansion lower than that of said metallic element to form a composite and

said composite then subjected to a beam of high frequency microwave radiation to pyrolyze said polymeric ceramic precursor to a ceramic.

Claim 21: The tubular ceramic/metal composite of claim 20 wherein

said at least one metallic element is first associated with an outer layer of a polymeric ceramic precursor having a thermal expansion lower than that of said metallic element to form a composite and

the polymeric ceramic precursor in the composite then pyrolyzed to a ceramic by a steerable beam of high frequency microwave radiation.

Claim 22: The tubular fiber reinforced ceramic/metal composite of claim 21 wherein

said at least one metallic tube is first associated with an outer layer of a fiber reinforcement infiltrated with a polymeric ceramic precursor having a thermal expansion lower than that of said metallic tube to form a composite and

said composite then subjected to a steerable beam of high frequency microwave radiation to pyrolyze said polymeric ceramic precursor to a ceramic.